

U.S. DEPARTMENT OF COMMERCE PATENT & TRADEMARK OFFICE

B/O Form PTO-1390		Transmittal Letter to the United States Designated/Elected Office (DO/EO/US) Concerning a Filing Under 35 USC 371		Attorney's Docket Number SCHM3002/JEK
International Application Number PCT/EP00/08415		International Filing Date 29 August 2000		U.S. Application Number 10/069116
Title of Invention SAFETY ELEMENT AND A VALUABLE OBJECT		Priority Date Claimed 31 August 1999		
Applicant(s) for DO/EO/US Christian SCHMITZ		Assignee		

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items under 35 USC 371:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 USC 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 USC 371.
3. ☒ This express request to begin national examination procedures (35 USC 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 USC 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed 35 USC 371(c)(2).
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 USC 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 USC 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 USC 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 USC 371(c)(4)). (☐ Executed ☒ Unexecuted)
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 USC 371(c)(5)).

Items 11 to 16 below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
 ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: 4 sheets formal drawings

Application Number (if Known) 10/069116		International Application Number PCT/EP00/08415		Attorney's Docket Number SCHM3002/JEK	
				Calculations	PTO USE ONLY
17. The following fees are submitted: Basic National Fee (37 CFR 1.492(a)(1)-(5)): <input checked="" type="checkbox"/> Search report has been prepared by the EPO or JPO \$890.00 <input type="checkbox"/> International Preliminary Examination Fee paid to USPTO (37 CFR 1.482) \$710.00 <input type="checkbox"/> No International Preliminary Examination Fee paid to USPTO (37 CFR 1.482) but International Search Fee paid to USPTO (37 CFR 1.445(a)(2)) \$740.00 <input type="checkbox"/> Neither International Preliminary Examination Fee (37 CFR 1.482) nor International Search Fee (37 CFR 1.445(a)(2)) paid to USPTO \$1040.00 <input type="checkbox"/> International Preliminary Examination Fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00					
ENTER APPROPRIATE BASIC FEE AMOUNT				\$ 890.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).					
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	39 -20 =	19	× \$18.00	\$ 342.00	
Independent Claims	4 -3 =	1	× \$84.00	\$ 84.00	
Multiple Dependent Claims (if applicable)			+ \$280.00		
TOTAL OF ABOVE CALCULATIONS				\$ 1,316.00	
Reduction by ½ for filing by small entity, if applicable. Small Entity Status is asserted pursuant to 37 CFR 1.27 for this application.					
SUBTOTAL				\$ 1,316.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).					
TOTAL NATIONAL FEE				\$ 1,316.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property.					
TOTAL FEES ENCLOSED				\$ 1,316.00	
			Amount to be:	Refunded:	
				Charged:	

- a. ☒ A check in the amount of **\$1,316.00** to cover the fees is enclosed.
 b. ☐ Please charge my **Deposit Account Number 02-0200** in the amount of \$_____ to cover the above fees.
 A duplicate copy of this sheet is enclosed.
 c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to **Deposit Account Number 02-0200**. A duplicate copy of this sheet is enclosed.

Note: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.



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DATE: 28 February 2002

Respectfully submitted,

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10/069116

JC19 Rec'd PCT/PTO 28 FEB 2002

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

International Patent Application
No. PCT/EP00/08415

PCT/DO/EO/US

International Filing Date: 29 August 2000

Attorney Docket: SCHM3002/JEK

Applicant: Christian SCHMITZ

For: SAFETY ELEMENT AND A VALUABLE OBJECT

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

This paper accompanies documents submitted to establish the U.S. national stage of the above-identified international patent application.

The international patent application was amended under PCT Article 34 and an English translation of the claims annexed to the International Preliminary Examination Report (IPER) is submitted herewith.

Before calculation of the filing fee and before examination, kindly amend the claims as annexed to the IPER as follows:

IN THE CLAIMS:

Please amend the claims as annexed to the IPER as shown on the appended APPENDIX OF CLAIMS, which includes amended and non-amended claims. Also appended hereto is an APPENDIX OF MARKED UP CLAIMS showing the changes which have been made.

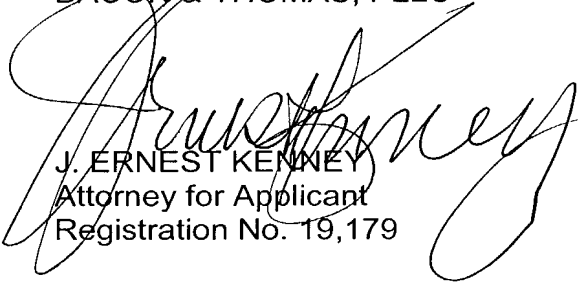
REMARKS

All rights are reserved to the original claimed subject matter. The claims have been amended to reduce the filing fees. None of the amendments are intended to

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narrow any element of the claims as they stood prior to amendment. Examination of the application as amended is respectfully requested.

Respectfully submitted,
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APPENDIX OF CLAIMS

1. An object of value with a security element disposed completely on the surface of the object of value, the security element having a thermochromic layer, characterized in that the thermochromic layer is combined with an additional, optically effective effect layer having visually and/or machine testable properties.
2. An object of value according to claim 1, characterized in that the effect layer has luminescent and/or magnetic properties.
3. An object of value according to claim 2, characterized in that the effect layer is a printing ink containing luminescent pigments and/or preferably further coloring pigments.
4. An object of value according to claim 1, characterized in that the effect layer is a directly reflecting layer.
5. An object of value according to claim 4, characterized in that the directly reflecting layer is a translucent layer producing different color effects in reflected light upon a change of viewing angle.
6. An object of value according to claim 5, characterized in that the translucent layer contains interference layer pigments or liquid crystal pigments.
7. An object of value according to claim 5, characterized in that the translucent layer has a relief structure in the form of a diffraction structure which is combined with a transparent dielectric layer.

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8. An object of value according to claim 4, characterized in that the directly reflecting layer is a metal layer, preferably an aluminum layer.

9. An object of value according to claim 8, characterized in that the metal layer is present at least in certain areas in the form of a screen.

10(Amended). An object of value according to claim 8, characterized in that the metal layer has gaps in the form of characters and/or patterns.

11. An object of value according to claim 10, characterized in that a metal layer, preferably an aluminum layer, is disposed in the form of a screen in the gaps.

12. An object of value according to claim 10, characterized in that a second thermochromic layer in the form of characters and/or patterns is present in the gaps.

13(Amended). An object of value according to claim 9, characterized in that the screen is present in the form of a dot or line screen.

14(Amended). An object of value according to claim 8, characterized in that a layer having a relief structure in the form of diffraction structures is disposed under the metal layer.

15(Amended). An object of value according to claim 1, characterized in that the thermochromic layer is all over.

16(Amended). An object of value according to claim 1, characterized in that the thermochromic layer is provided only in certain areas.

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17. An object of value according to claim 16, characterized in that the thermochromic layer is provided in the form of characters and/or patterns.

18. An object of value according to claim 16, characterized in that the thermochromic layer is combined with at least one further thermochromic or visually recognizable layer, the layers supplementing each other to form recognizable information.

19(Amended). An object of value according to claim 1, characterized in that the thermochromic layer is disposed over the effect layer.

20(Amended). An object of value according to claim 1, characterized in that the thermochromic layer is disposed under the effect layer.

21. An object of value according to claim 20, characterized in that information in the form of characters and/or patterns is disposed under the thermochromic layer.

22. An object of value according to claim 21, characterized in that the information is printed or produced by means of a laser.

23(Amended). An object of value according to claim 20, characterized in that the information has visually and/or machine testable properties.

24. An object of value according to claim 23, characterized in that the information has luminescent or magnetic properties.

25(Amended). An object of value according to claim 21, characterized in that the information is black.

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26(Amended). An object of value according to claim 1, characterized in that the thermochromic layer is opaque below a predetermined temperature and at least translucent above said temperature.

27(Amended). An object of value according to claim 1, characterized in that the thermochromic layer is translucent or transparent below a predetermined temperature and opaque above said temperature.

28(Amended). An object of value according to claim 1, characterized in that the security element is a label.

29(Amended). An object of value according to claim 1, characterized in that the object of value is a security paper, security document or product package.

30. A security element for protecting objects of value, the security element having a thermochromic layer which is combined with a translucent layer which produces different color effects in reflected light upon a change of viewing angle, and the thermochromic layer being disposed under the translucent layer, characterized in that the translucent layer has a relief structure in the form of a diffraction structure which is combined with a transparent dielectric layer or contains liquid crystal pigments.

31. A security element according to claim 30, characterized in that the thermochromic layer is opaque below a predetermined temperature and at least translucent above said temperature.

32. A security element for protecting objects of value, the security element having a thermochromic layer, characterized in that the thermochromic layer is

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combined with a metal layer which is present at least in certain areas in the form of a screen.

33. A security element according to claim 32, characterized in that the metal layer has gaps in the form of characters and/or patterns.

34. A security element according to claim 33, characterized in that a metal layer, preferably an aluminum layer, is disposed in the form of a screen in the gaps.

35. A security element according to claim 33, characterized in that a second thermochromic layer in the form of characters and/or patterns is present in the gaps.

36(Amended). A security element according to claim 32, characterized in that the screen is present in the form of a dot or line screen.

37(Amended). A security element according to claim 32, characterized in that a layer having a relief structure in the form of diffraction structures is disposed under the metal layer.

38(Amended). A transfer material for producing a security element according to claim 30, characterized in that the transfer material has a carrier material on which a security element according to claim 30 is disposed as a transferable layer.

39. A transfer material according to claim 38, characterized in that the transfer material is formed as a hot stamping foil.

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APPENDIX OF MARKED-UP VERSION OF CLAIMS

10(Amended). An object of value according to claim 8 [or 9], characterized in that the metal layer has gaps in the form of characters and/or patterns.

13(Amended). An object of value according to [at least one of claims 9 to 12] claim 9, characterized in that the screen is present in the form of a dot or line screen.

14(Amended). An object of value according to [at least one of claims 8 to 13] claim 8, characterized in that a layer having a relief structure in the form of diffraction structures is disposed under the metal layer.

15(Amended). An object of value according to [at least one of claims 1 to 14] claim 1, characterized in that the thermochromic layer is all over.

16(Amended). An object of value according to [at least one of claims 1 to 14] claim 1, characterized in that the thermochromic layer is provided only in certain areas.

19(Amended). An object of value according to [at least one of claims 1 to 18] claim 1, characterized in that the thermochromic layer is disposed over the effect layer.

20(Amended). An object of value according to [at least one of claims 1 to 18] claim 1, characterized in that the thermochromic layer is disposed under the effect layer.

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23(Amended). An object of value according to claim 20 [or 21], characterized in that the information has visually and/or machine testable properties.

25(Amended). An object of value according to [at least one of claims 21 to 24] claim 21, characterized in that the information is black.

26(Amended). An object of value according to [at least one of claims 1 to 25] claim 1, characterized in that the thermochromic layer is opaque below a predetermined temperature and at least translucent above said temperature.

27(Amended). An object of value according to [at least one of claims 1 to 25] claim 1, characterized in that the thermochromic layer is translucent or transparent below a predetermined temperature and opaque above said temperature.

28(Amended). An object of value according to [at least one of claims 1 to 27] claim 1, characterized in that the security element is a label.

29(Amended). An object of value according to [at least one of claims 1 to 28] claim 1, characterized in that the object of value is a security paper, security document or product package.

36(Amended). A security element according to [at least one of claims 32 to 35] claim 32, characterized in that the screen is present in the form of a dot or line screen.

37(Amended). A security element according to [at least one of claims 32 to 36] claim 32, characterized in that a layer having a relief structure in the form of diffraction structures is disposed under the metal layer.

[illegible]

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Security element

This invention relates to a security element for protecting objects of value, the security element having a thermochromic layer. The invention relates further to an object of value, a security document and a security paper with such a security element and to a foil material for producing such a security element.

It has been known for some time to use thermochromic materials for protecting documents of value. For example, DT 22 12 350 describes a security thread made of transparent plastic which has cavities. Said cavities contain a liquid-crystalline material which shows a reversible color change upon an increase or decrease of temperature.

EP 0 608 078 B1 likewise discloses a security thread with thermochromic properties. In this case a plastic material is provided with a print or with characters which are formed by partly demetalizing a metal layer. Said print or negative characters bear a thermochromic coating which is colored at normal temperature. When heated the thermochromic coating becomes colorless so that the characters therebelow become recognizable. Alternatively, a thermochromic coating can be used which is colorless at normal temperature and becomes colored when heated so that the characters disappear. Said thread is incorporated into the security paper so as to pass directly to the surface in certain areas, so-called "windows."

Such thermochromic security threads have the disadvantage, however, that they are very narrow and the thermochromic effect is recognizable only in the relatively small window areas, so that the optical effect evoked by the color change of the thermochromic material is very inconspicuous. Such security elements therefore do not offer very high protection from forgery.

The invention is therefore based on the problem of providing a security element that offers high protection from forgery and avoids the disadvantages of the prior art.

This problem is solved by the features of the independent claims. Developments are the subject matter of the subclaims.

According to the invention, the security element is disposed completely on the surface of the object and combined with an effect layer having visually and/or machine

testable properties. Since the security element is disposed completely on the surface of the object it can be executed over a substantially greater surface so that the color change of the thermochromic material is substantially more conspicuous due to the greater surface. The combination with an effect layer having further visually and/or machine testable properties additionally gives the security element greater protection from forgery, since such effect layers either are elaborate to produce or cannot readily be procured on the market.

Said effect layers can be for example special luminescent or magnetic substances which are added to a printing ink for example.

The printing ink can of course contain further coloring pigments. It is preferably applied in the form of a pattern or alphanumeric characters.

Alternatively, the effect layer can also be a directly reflecting layer, such as a translucent layer, which produces different color effects in reflected light upon a change of viewing angle. Such optically variable properties are found for example in interference layer pigments or liquid crystal pigments that can be added to a transparent binder or a transparent plastic layer. However, the optically variable effect can also be produced with transparent diffraction grating structures. In this case a translucent or transparent layer, preferably a lacquer layer, is provided with a relief structure in the form of a diffraction structure. The relief structure is then combined with a transparent dielectric layer to permit the optically variable effect of the diffraction structure to be observed in reflected light. Simultaneously, information disposed under the diffraction structure can be recognized due to the transparency of the layers.

The directly reflecting layer can alternatively be formed as a metal layer, preferably aluminum layer. The metal layer is executed either all over or at least in certain areas in the form of a screen. Additionally, the metal layer can have gaps in the form of characters or patterns in which a metal layer can likewise be disposed in the form of a screen. This second metal layer preferably likewise consists of an aluminum layer. That is, the directly reflecting layer can, according to a special embodiment, consist of a metallic screen with a predetermined screen dot size and screen width with

areas incorporated therein which vary with respect to screen width and/or screen dot size. In this way readable characters or patterns can be provided in the reflecting layer. The screen elements need not necessarily be dots, however. They can also consist of lines or other geometrical shapes.

According to a further embodiment, thermochromic characters or patterns can be disposed in the gaps of the reflecting layer. The color change temperature of this thermochromic layer is preferably different from that of the first thermochromic layer.

Moreover, the metal layer can be combined with a further layer with a relief structure in the form of diffraction structures incorporated therein.

The inventive thermochromic layer can also be varied in numerous ways within the scope of the invention. Thus, the thermochromic layer can be provided all over or only in certain areas, preferably in the form of characters or patterns. A further possibility is to combine the thermochromic layer with at least one further thermochromic or visually recognizable layer, the two layers supplementing each other to form recognizable information.

Depending on the effect layer, the thermochromic layer can be disposed over or under the effect layer. If the thermochromic layer is disposed under a transparent effect layer, further information in the form of characters and/or patterns can be disposed below the thermochromic layer. Said information can in turn be alternatively printed or produced by a laser. The information is preferably black. Other color designs are not excluded, however. Additionally, the information can have visually and/or machine testable properties such as luminescence or magnetism.

The thermochromic substances used for the thermochromic layer are preferably opaque below a predetermined temperature and at least translucent above said temperature. In certain applications it may be expedient to use thermochromic substances that are translucent or transparent below a predetermined temperature and opaque above said temperature. The color change temperature of the thermochromic substances is preferably above ambient temperature, e.g. in the range of 25°C to 60°C, preferably 30°C to 60°C.

The individual layers of the security element can be either produced directly on the object of value or prepared on a separate carrier. In the latter embodiment the security element can be formed for example as a self-supporting label. Alternatively, it is also possible to produce a transfer material whereby the layer structure of the later security element is prepared in endless form on a carrier material. The layer structure is then transferred to the object of value from said carrier material in the desired outline form with the aid of an adhesive. A hot-melt adhesive is preferably used for this purpose. In order to fix the outline form of the security element, an adhesive layer can either be provided only in the areas to be transferred, or the adhesive, such as a hot-melt adhesive, is activated only in the areas to be transferred.

The object of value to which the security element is applied can be for example a security paper, a security document or a product package. Other objects of value requiring security-type protection can of course also be provided with the inventive security element.

Further advantages and embodiments of the invention will be explained in more detail with reference to the figures, in which:

Fig. 1 shows a security document with an inventive security element,

Figs. 2 to 11 show different embodiments of the security document in cross section.

The invention will for clarity's sake be explained in more detail by the example of a bank note.

Fig. 1 shows such a bank note 1 made of paper or plastic and provided with security element 2 in the form of a strip extending over the total width of the bank note. Bank note 1 can of course have further security features such as watermarks, steel intaglio, security thread or luminescent or magnetic prints or the like.

Security element 2 has a thermochromic layer which is combined with an effect layer which in turn has visually and/or machine testable properties. Security element 2 is disposed completely on the surface of bank note 1 so that the color change of the thermochromic layer preferably applied all over is very well recognizable.

Besides the thermochromic layer and the effect layer, security element 2 can also have further layers that produce further striking optical effects alone or in combination with other layers of the security element. Some preferred embodiments will be explained in more detail with reference to Figs. 2 to 10 which show bank note 1 in cross section along dash-dotted line A - A to illustrate the layer structure of security element 2.

According to Fig. 2, paper or plastic substrate 3 of bank note 1, said substrate having a white or light inherent color, is provided with thermochromic print 4 in the form of characters or patterns. Over thermochromic layer 4 there is directly reflecting translucent layer 5 that produces different color effects in reflected light upon a change of viewing angle. This effect is called an "optically variable" effect. Layer 5 can be for example a printing ink consisting of a transparent binder with interference layer pigments or liquid crystal pigments mixed thereinto.

Since said pigments are transparent and have little or no inherent body color, the visually recognizable optical impression of said pigments is determined very largely by the background. On a diffusely reflecting white or light background the pigments hardly appear, since the diffusely reflected scattered light overlays the optically variable effect based on interference effects. On a dark background, however, the interplay of colors of said pigments stands out especially well, since the background absorbs the transmitted radiation.

For this reason the thermochromic material used for layer 4 is preferably opaque at normal ambient temperature and has a dark, preferably black, inherent color. In this case the optically variable effect produced by effect layer 5 stands out especially in the area of thermochromic layer 4, so that the characters represented by thermochromic layer 4 become visible. Above the color change temperature of thermochromic layer 4 the latter preferably becomes colorless or changes to another, substantially lighter color so that the characters are no longer recognizable.

The reverse effect occurs if a thermochromic material is used which is light or transparent at normal ambient temperature and opaque, preferably black, only above a certain activation temperature.

In Fig. 3, substrate 3 is provided with thermochromic print 4 and further print 7. Disposed thereabove is optically variable, transparent layer 5, as in Fig. 2. Print 4 and print 7 supplement each other to form total information, which can consist of a text, picture, pattern or the like. Print 7 has no thermochromic properties but can show the same visual color effect as thermochromic layer 4.

The thermochromic material used for print 4 is preferably opaque at normal ambient temperature and has a dark inherent color. Print 7 is likewise selected to be dark so that optically variable layer 5 can only be clearly perceived in the area of prints 4, 7 and thus the information represented by prints 4, 7 is recognizable. When the security element is heated to a temperature above the color change temperature of the thermochromic material, the information portion represented by print 4 disappears since thermochromic layer 4 becomes colorless or changes to another, substantially lighter color.

The reverse case also occurs here if a thermochromic material is used which is colorless at room temperature or has a light body color and becomes opaque or dark only above the color change temperature.

Fig. 4 shows a layer structure wherein substrate 3 is provided with dark, preferably black, print 6 in a first step. Applied over print 6 is all-over layer 4 of thermochromic material, followed by optically variable translucent layer 5. If the material used for thermochromic layer 4 is again dark and opaque at ambient temperature, optically variable layer 5 appears as a brilliant layer with an interplay of colors. Above the color change temperature of the thermochromic material, layer 4 becomes transparent and optically variable layer 5 can only be recognized well in the area of marking 6 therebelow. In this way it is possible to produce information that is only visible above the color change temperature of the thermochromic material.

The reverse effect of course also occurs here if a thermochromic material is used which becomes opaque only above the color change temperature. In this case only marking 6 is recognizable as optically variable information at ambient temperature. Above the activation temperature of the thermochromic material, said marking

disappears since the thermochromic layer becomes opaque and thus total layer 5 is recognized as an optically variable layer.

In the embodiment shown in Fig. 5, the effect layer designated 5 in Fig. 4 is replaced with a combination of layers 8 and 9. Layer 8 is a transparent lacquer or plastic layer with a relief structure in the form of diffraction structures embossed into the surface thereof. Said relief structure is combined with thin, dielectric, likewise transparent reflection layer 9 whose refractive index is coordinated with the refractive index of layer 8 such that the diffraction structure can be viewed in reflected light, on the one hand, while transparency of the diffraction structures is simultaneously guaranteed. Like the interference layer or liquid crystal pigments explained above in connection with Fig. 2, the diffraction structure cannot be recognized properly or at all on a light background due to its transparency, while it is clearly visible against a dark background. In the embodiment shown in Fig. 5, the same optical effects therefore occur as explained above in connection with Fig. 4.

In the embodiments described with reference to Figs. 2 and 3, layer 5 can also be replaced with a combination of embossed layer 8 and dielectric reflection layer 9.

Fig. 6 shows a further embodiment of the inventive document of value. Here, substrate 3 is provided with metal layer or layer with metallic luster 10 which is executed at least in certain areas in the form of screen 11. Screened areas 11 can have the form of characters, patterns, pictures or the like. Above layer 10 there is thermochromic layer 4 disposed all over. Depending on the thermochromic material used, layer 10 is visible at room temperature or above the color change temperature of thermochromic layer 4.

Fig. 7 shows a similar embodiment. In this case the metal layer or layer with metallic luster is executed as a screen in the total area. It consists of background screen 12 with a certain screen dot size or screen width and at least one partial area 13 in which the screen has a smaller screen width and smaller screen dot size. This screen variation permits visually readable information to be represented which is visible at certain temperatures depending on thermochromic material 4 used.

Screened layers 10, 11, 12, 13 shown in Figs. 6 and 7 can additionally be combined with an embossed layer. Such an embodiment is shown in Fig. 8. In this case, uniformly screened metal layer 14 forms the reflection layer for a diffraction structure therebelow that is embossed into transparent lacquer layer 8. Through the gaps in screened layer 14, information therebelow can be recognized. Under embossed layer 8 thermochromic layer 4 and print 15 are disposed all over, print 15 directly adjoining substrate 3. If thermochromic layer 4 used is opaque at room temperature, the diffraction structure is recognizable in reflected light under normal conditions. Simultaneously, the color effect of thermochromic layer 4 is perceptible due to the transparent and thus translucent diffraction structure. When the security element is heated to a temperature above the color change temperature of thermochromic layer 4, the latter likewise becomes transparent and information 15 can be recognized and read through screened layer 14.

If thermochromic material 4 used is translucent at room temperature, the reverse effect occurs and information 15 becomes invisible above the color change temperature of thermochromic layer 4.

The screen dot sizes or screen dot densities can be selected in accordance with the particular requirements in the examples shown. The screen elements used need not necessarily be dots. Other geometrical shapes such as lines, squares, triangles or the like are likewise possible.

Fig. 9 shows an embodiment wherein substrate 3 is provided with effect layer 16, preferably a metal layer, which has gaps in the form of characters, patterns, pictures or the like. In the area of said gaps there is thermochromic layer 4 likewise in the form of information. Said information can be identical in content to the information represented by the gaps and extend congruently thereto.

According to a preferred embodiment, the material used for thermochromic layer 4 is translucent or transparent at room temperature. The information represented by layer 4 becomes readable only above the color change temperature of the thermochromic material. For example, the term "Valid" can appear in the area of the gaps when heated.

In a further variant, layer 16 can have disposed thereon all over a further thermochromic layer which is for example opaque at room temperature and becomes colorless or translucent above the color change temperature. The color change temperature of said layer is preferably somewhat below the color change temperature of layer 4, so that when heated above the first color change temperature the all-over thermochromic layer becomes transparent or translucent and gives a view of layers 16, 4 therebelow. When heated further, the information represented by layer 4 appears, or disappears, or changes its color, depending on which thermochromic material is used for layer 4.

Alternatively or additionally, a further print that can at least partly have thermochromic properties can be present under layer 16.

Fig. 10 shows an embodiment wherein substrate 3 is first provided with embossed layer 8 and reflection layer 17 which ensures that the diffraction structures incorporated into embossed layer 8 can be observed in reflected light. Above reflection layer 17 at least one thermochromic layer 4 in the form of information is applied. The spaces in said information are filled with color layer 18 which shows the same color effect as thermochromic layer 4, so that the impression of an all-over uniform coating arises at room temperature. Only when heated above the color change temperature of thermochromic layer 4 does the latter become at least translucent and give a view of the diffraction structure therebelow. Since the diffractive areas have the outline form of the information represented by thermochromic layer 4, said information likewise becomes recognizable.

According to Fig. 11, substrate 3 likewise has adjacent thereto embossed layer 8 which is combined with reflection layer 17. Above reflection layer 17 there is thermochromic layer 4 disposed all over. Further print 19 is finally located on thermochromic layer 4. The thermochromic material used here is also preferably opaque at room temperature. Only when heated above the color change temperature of the thermochromic material does the diffraction structure therebelow become visible. Layer 4 and print 19 can also have the same or different colors.

This embodiment is also suitable for protecting a signature stripe for example. The signature stripe consists in this case of embossed layer 8, reflection layer 17 and all-over thermochromic coating 4. Print 19 is replaced in this case with the user's signature. For authenticity testing of the signature stripe, the thermochromic layer is activated so that it becomes transparent or translucent and the diffraction structures become visible under the signature.

The diffraction structures mentioned in the various examples can be holograms or any grating structures, such as pixelgrams, Kinegrams® or the like.

It is likewise possible that thermochromic layer 4 and/or at least one of color layers 6, 7, 15, 18, 19 shown have further visually and/or machine testable properties such as electric conductivity, magnetism, luminescence or the like. To give the particular print electrically conductive properties, it suffices for example to add a sufficient amount of carbon black pigments to the printing inks used. Since the nonthermochromic prints are likewise to have a dark, preferably black, inherent color in many examples, they can be equipped with magnetic properties in a very simple way by using dark magnetic pigments instead of coloring pigments.

The thermochromic layer can also have a plurality of thermochromic materials with different color change temperatures. It is likewise possible to compose the thermochromic layer of a plurality of color layers which contain different thermochromic materials with different color change temperatures.

Since it may be difficult to provide the object of value with the particular layer sequence directly in some cases, it may be useful to prepare the layer structure of the security element at least partly on a transfer material. This procedure is expedient in particular when using diffraction structures which are combined with a reflection layer, since the reflection layer is normally vapor-deposited and the production of metallic screen structures also requires special production steps such as etching or washing, depending on which specific demetalizing method is applied. It is therefore expedient to form at least the diffraction structures and the associated reflection layer as a hot stamping foil and then combine said foil in register with the other layers of the security element on the object of value.

If the total layer sequence of the security element is prepared on a transfer material, it is to be heeded that the layer structure shown in the various figures must be prepared on the carrier band of the transfer material in the reverse order. The layer structure of the security element can be prepared on the carrier band in endless form or else already in the final outline form used as the security element. The security element is transferred to an object of value to be protected with the aid of an adhesive layer which is applied either to the object of value or to the uppermost layer of the transfer material. After transfer, the carrier band of the transfer material is removed and only the shown layer structure of the security element remains on the object of value to be protected.

Claims

1. An object of value with a security element, the security element having a thermochromic layer, characterized in that the security element is disposed completely on the surface of the object of value, and the thermochromic layer is combined with an effect layer having visually and/or machine testable properties.
2. An object of value according to claim 1, characterized in that the effect layer has luminescent and/or magnetic properties.
3. An object of value according to claim 2, characterized in that the effect layer is a printing ink containing luminescent and/or magnetic pigments and preferably further coloring pigments.
4. An object of value according to claim 1, characterized in that the effect layer is a directly reflecting layer.
5. An object of value according to claim 4, characterized in that the directly reflecting layer is a translucent layer producing different color effects in reflected light upon a change of viewing angle.
6. An object of value according to claim 5, characterized in that the translucent layer contains interference layer pigments or liquid crystal pigments.
7. An object of value according to claim 5, characterized in that the translucent layer has a relief structure in the form of a diffraction structure which is combined with a transparent dielectric layer.
8. An object of value according to claim 4, characterized in that the directly reflecting layer is a metal layer, preferably an aluminum layer.
9. An object of value according to claim 8, characterized in that the metal layer is present at least in certain areas in the form of a screen.
10. An object of value according to claim 8 or 9, characterized in that the metal layer has gaps in the form of characters and/or patterns.
11. An object of value according to claim 10, characterized in that a metal layer, preferably an aluminum layer, is disposed in the form of a screen in the gaps.

12. An object of value according to claim 10, characterized in that a second thermochromic layer in the form of characters and/or patterns is present in the gaps.

13. An object of value according to at least one of claims 9 to 12, characterized in that the screen is present in the form of a dot or line screen.

14. An object of value according to at least one of claims 8 to 13, characterized in that a layer having a relief structure in the form of diffraction structures is disposed under the metal layer.

15. An object of value according to at least one of claims 1 to 14, characterized in that the thermochromic layer is all over.

16. An object of value according to at least one of claims 1 to 14, characterized in that the thermochromic layer is provided only in certain areas.

17. An object of value according to claim 16, characterized in that the thermochromic layer is provided in the form of characters and/or patterns.

18. An object of value according to claim 16, characterized in that the thermochromic layer is combined with at least one further thermochromic or visually recognizable layer, the layers supplementing each other to form recognizable information.

19. An object of value according to at least one of claims 1 to 18, characterized in that the thermochromic layer is disposed over the effect layer.

20. An object of value according to at least one of claims 1 to 18, characterized in that the thermochromic layer is disposed under the effect layer.

21. An object of value according to claim 20, characterized in that information in the form of characters and/or patterns is disposed under the thermochromic layer.

22. An object of value according to claim 21, characterized in that the information is printed or produced by means of a laser.

23. An object of value according to claim 20 or 21, characterized in that the information has visually and/or machine testable properties.

24. An object of value according to claim 23, characterized in that the information has luminescent or magnetic properties.

25. An object of value according to at least one of claims 21 to 24, characterized in that the information is black.

26. An object of value according to at least one of claims 1 to 25, characterized in that the thermochromic layer is opaque below a predetermined temperature and at least translucent above said temperature.

27. An object of value according to at least one of claims 1 to 25, characterized in that the thermochromic layer is translucent or transparent below a predetermined temperature and opaque above said temperature.

28. An object of value according to at least one of claims 1 to 27, characterized in that the security element is a label.

29. An object of value according to at least one of claims 1 to 28, characterized in that the object of value is a security paper, security document or product package.

30. A security element for protecting objects of value, the security element having a thermochromic layer, characterized in that the thermochromic layer is combined with a translucent layer which produces different color effects in reflected light upon a change of viewing angle, the thermochromic layer being disposed under the translucent layer.

31. A security element according to claim 30, characterized in that the translucent layer contains interference layer pigments or liquid crystal pigments.

32. A security element according to claim 30, characterized in that the translucent layer has a relief structure in the form of a diffraction structure which is combined with a transparent dielectric layer.

33. A security element according to at least one of claims 30 to 32, characterized in that the thermochromic layer is opaque below a predetermined temperature and at least translucent above said temperature.

34. A security element for protecting objects of value, the security element having a thermochromic layer, characterized in that the thermochromic layer is combined with a metal layer which is present at least in certain areas in the form of a screen.

35. A security element according to claim 34, characterized in that the metal layer has gaps in the form of characters and/or patterns.

36. A security element according to claim 35, characterized in that a metal layer, preferably an aluminum layer, is disposed in the form of a screen in the gaps.

37. A security element according to claim 35, characterized in that a second thermochromic layer in the form of characters and/or patterns is present in the gaps.

38. A security element according to at least one of claims 34 to 37, characterized in that the screen is present in the form of a dot or line screen.

39. A security element according to at least one of claims 34 to 38, characterized in that a layer having a relief structure in the form of diffraction structures is disposed under the metal layer.

40. A transfer material for producing a security element, characterized in that the transfer material has a carrier material on which a thermochromic layer is disposed which is combined with a reflecting layer.

41. A transfer material according to claim 40, characterized in that the transfer material is formed as a hot stamping foil.

Abstract

This invention relates to an object of value with a security element having a thermochromic layer and disposed completely on the surface of the object of value. The thermochromic layer is combined with an effect layer having visually and/or machine testable properties.

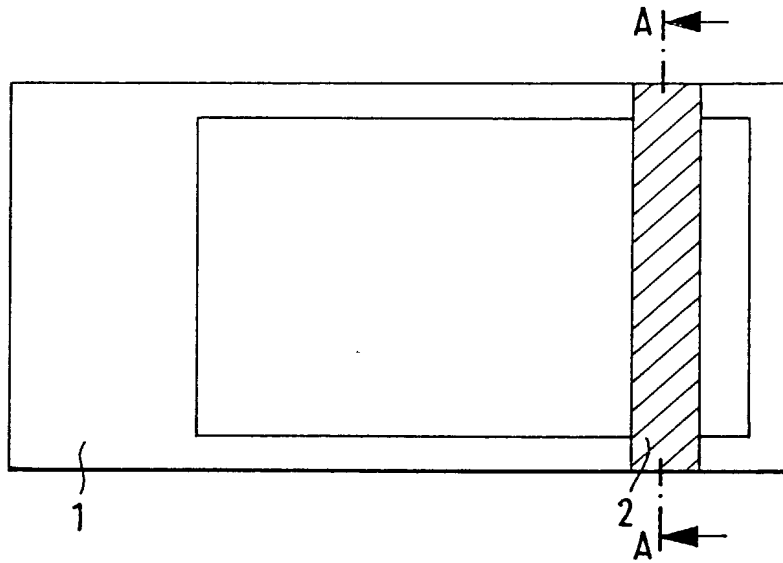


FIG. 1

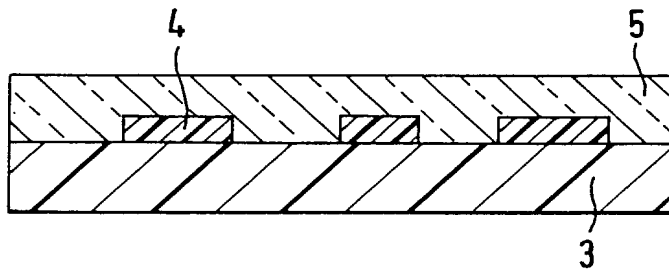


FIG. 2

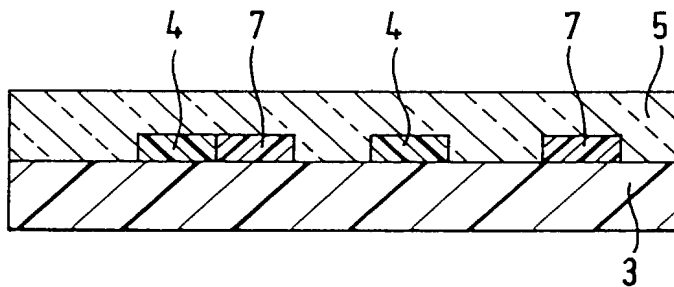


FIG. 3

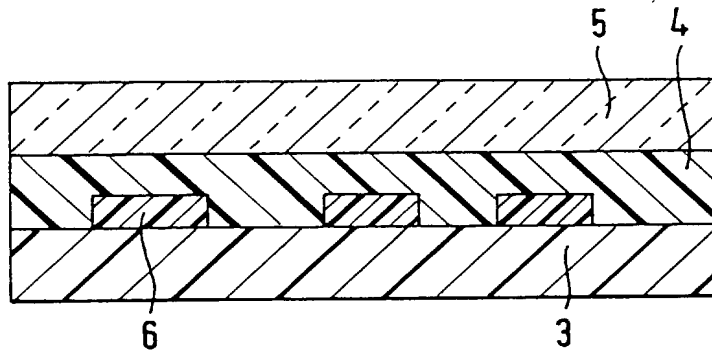


FIG. 4

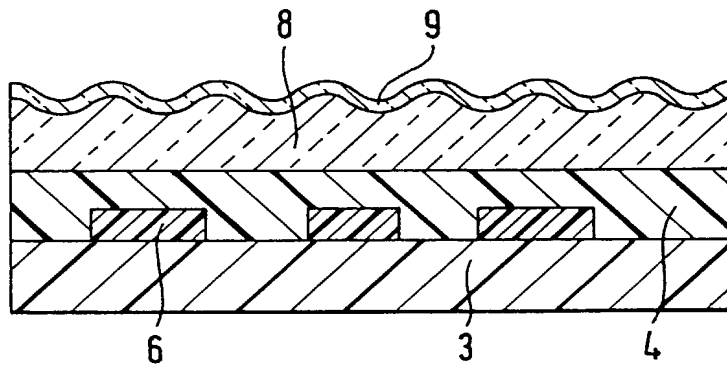


FIG. 5

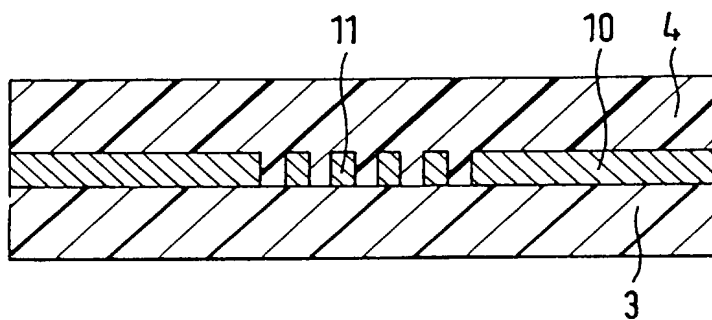


FIG. 6

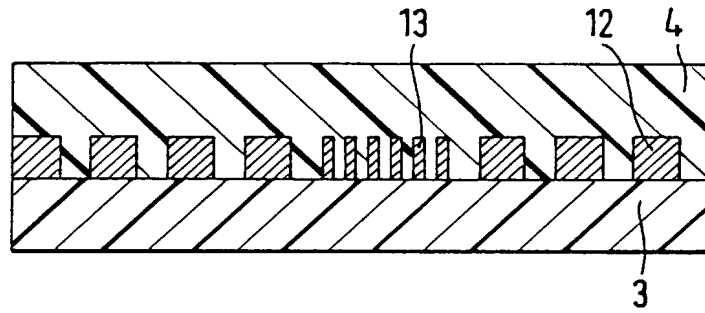


FIG.7

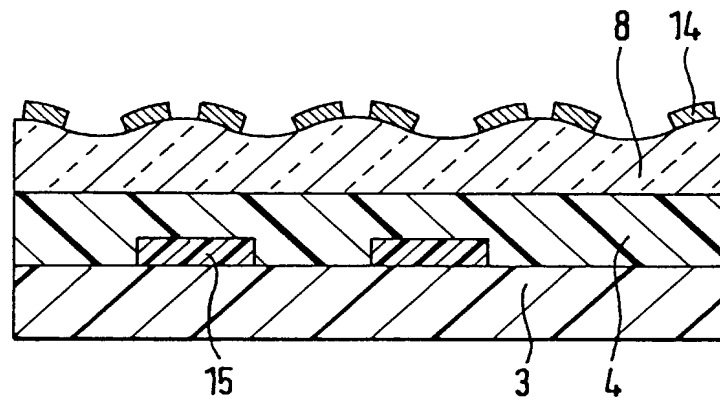


FIG.8

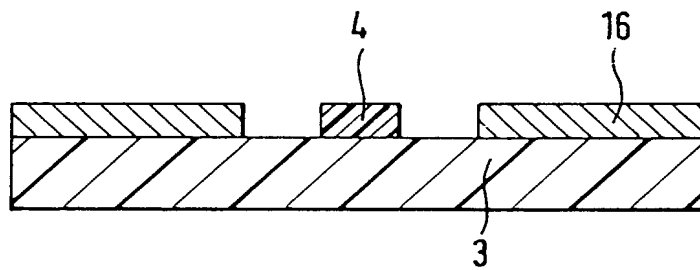


FIG.9

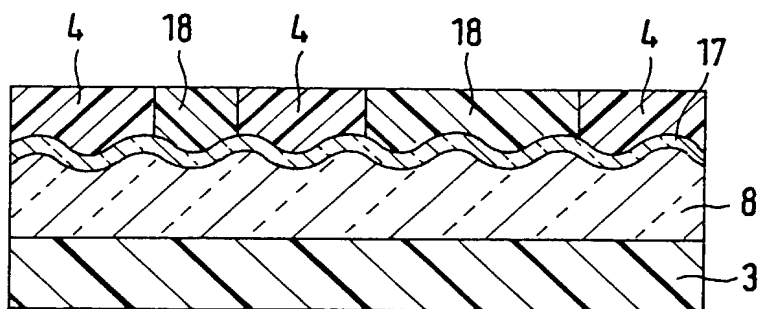


FIG.10

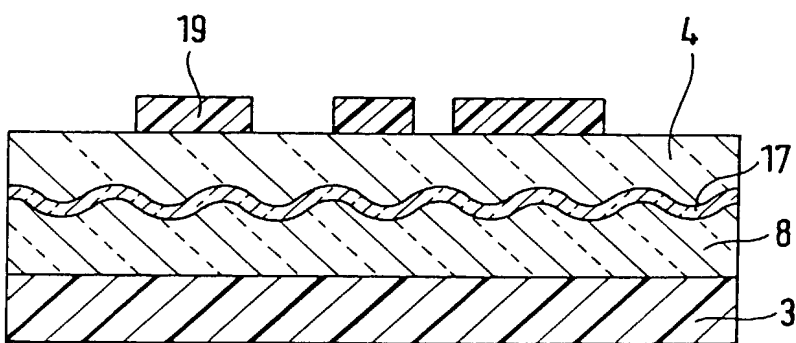


FIG.11

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES
PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
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(84) Bestimmungsstaaten (*regional*): ARIPO-Patent (GH,
GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), eura-
sisches Patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI,
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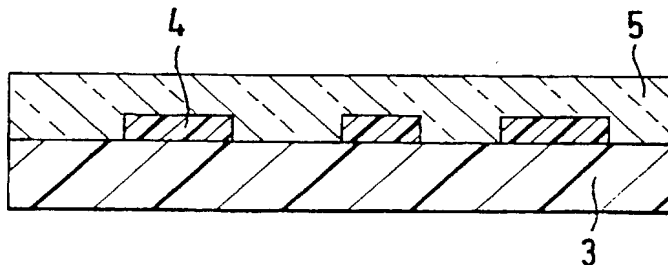
Veröffentlicht:

— Mit internationalem Recherchenbericht

Zur Erklärung der Zweibuchstaben-Codes, und der anderen
Abkürzungen wird auf die Erklärungen ("Guidance Notes on
Codes and Abbreviations") am Anfang jeder regulären Ausgabe
der PCT-Gazette verwiesen

(54) Title: SAFETY ELEMENT AND A VALUABLE OBJECT

(54) Bezeichnung: SICHERHEITSELEMENT UND WERTGEGENSTAND



(57) Abstract: The invention relates to a
valuable object with a safety element which
has a thermochromic layer and is located
completely on the surface of the valuable object.
The thermochromic layer is combined with
an effective layer which has visually and/or
machine examinable characteristics.

(57) Zusammenfassung: Die Erfindung
betrifft einen Wertgegenstand mit einem
Sicherheitselement, das eine thermochrome
Schicht aufweist und vollständig auf der
Oberfläche des Wertgegenstandes angeordnet ist.

Die thermochrome Schicht ist mit einer Effektschicht kombiniert, die visuell und/oder maschinell prüfbare Eigenschaften aufweist.

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*** DECLARATION FOR PATENT APPLICATION AND APPOINTMENT OF ATTORNEY**

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention (Design, if applicable) entitled: **SAFETY ELEMENT AND A VALUABLE OBJECT** the specification of which (check one)

☐ is attached hereto, or ☒ was filed on: **29 August 2000**

as U.S. Application Number or PCT

International Application Number: **(PCT/EP00/08415) 10/069,116**

and (if applicable) was amended on:

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in *Title 37, Code of Federal Regulations, §1.56*. I hereby claim foreign priority benefits under *Title 35, United States Code §119* of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)			PRIORITY CLAIMED	
Number	Country	Day/Month/Year Filed	Yes	No
199 41 295.2	Germany	31 August 1999	X	

☐ Additional Priority Application(s) Listed on Following Page(s)

I HEREBY CLAIM THE BENEFIT UNDER TITLE 35 U.S. CODE §119(E) OF ANY U.S. PROVISIONAL APPLICATIONS LISTED BELOW.	
Application Number	Day/Month/Year Filed

☐ Additional Provisional Application(s) Listed on Following Page(s)

I hereby claim the benefit under *Title 35, United States Code, §120* of any United States application(s) or PCT international application(s) designating The United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of *Title 35, United States Code, §112*, I acknowledge the duty to disclose information which is material to patentability as defined in *Title 37, Code of Federal Regulations, §1.56* which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

Application Number	Filing Date	Status - Patented, Pending or Abandoned

☐ Additional US/PCT Priority Application(s) listed on Following Page(s)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under *section 1001 of title 18 of the United States Code* and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

6 POWER OF ATTORNEY: I (We) hereby appoint as my (our) attorneys, with full powers of substitution and revocation, to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: J. Ernest Kenney, Reg. No. 19,179; Eugene Mar, Reg. No. 25,893; Richard E. Fichter, Reg. No. 26,382; Thomas J. Moore, Reg. No. 28,974; Joseph DeBenedictis, Reg. No. 28,502; Benjamin E. Urcia, Reg. No. 33,805, and

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DATE 03/27/02	SIGNATURE

☐ See following page(s) for additional joint inventors.